

THE PHONOCARDIOGRAM IN ENDOMYOCARDIAL FIBROSIS

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Endomyocardial fibrosis is a common cause of heart failure in Uganda. A clinico-pathological study of this cardiopathy reported by Ball *et al.* (1954) established that the fibrotic process, while involving the endocardium of the apices of the ventricles, not infrequently extends to the chordæ tendineæ and the cusps of the atrioventricular valves, tethering them down and producing atrioventricular incompetence. Clinically, this group which comprises the majority of cases presents as classical mitral regurgitation often with tricuspid regurgitation, and is associated very frequently with considerable atrial dilatation. An abnormal atrial electrocardiogram associated with low voltage QRS complexes and flattening or inversion of T waves has been found in over half of a series of 30 patients proved at necropsy to have endomyocardial fibrosis (Williams and Somers, 1960). We believe these electrocardiographic abnormalities to be distinctive of endomyocardial fibrosis.

In this paper we report on the phonocardiographic signs in 14 consecutive cases of clinically diagnosed endomyocardial fibrosis with atrioventricular regurgitation admitted to Mulago Hospital during a three-month period in 1958. There were 8 male and 6 female patients and their ages ranged from 12 to 65 years.

All the patients studied had been in congestive heart failure when first seen and in each instance heart failure had been controlled at the time of taking of the sound records. The diagnosis of atrioventricular regurgitation due to endomyocardial fibrosis was reached by careful exclusion of other causes of heart failure, particularly mitral stenosis, anæmia, aortic valve disease, and hypertensive heart disease. In practice the finding of an apical pansystolic murmur transmitted to the left axilla, sometimes as far as the left scapular region, accompanied by radiological evidence of expansion of the left atrium during ventricular systole, was regarded as evidence of mitral regurgitation.

In four of the patients studied there was organic tricuspid regurgitation in addition to the mitral lesion. Tricuspid regurgitation was diagnosed on the basis of a systolic murmur over the tricuspid area with inspiratory increase (Carvallo *et al.*, 1951) and systolic pulsation of the jugular veins and the liver.

A three-channel simultaneous electrocardiogram, carotid pulse pick-up, and phonocardiogram recording unit, manufactured by Messrs. Cardiac Recorders, London, was used throughout.

The murmur of mitral regurgitation was recorded from the area of maximal auscultatory intensity which was usually well outside the mid-clavicular line in the fifth interspace. Records were taken at the end of expiration. In the four cases with tricuspid regurgitation the phonocardiogram was recorded from the base of the xiphoid process or the lower end of the left sternal edge in both expiration and inspiration.

The simultaneous electrocardiographic lead recorded was lead II. All tracings were made with a film speed of 100 mm. a second.

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RESULTS

The Murmurs. The auscultatory impression that the murmur of atrioventricular regurgitation was pansystolic was confirmed by phonocardiography.

Characteristically the murmur started immediately after the first sound and filled systole, continuing up to the second sound with even intensity. The vibrations were mostly high pitched (Fig. 1). In the majority the murmur included the second sound and in two instances of mitral regurgitation the murmur was maximal in late systole and obscured the second sound (Fig. 2). In one case the murmur was maximal early in systole.

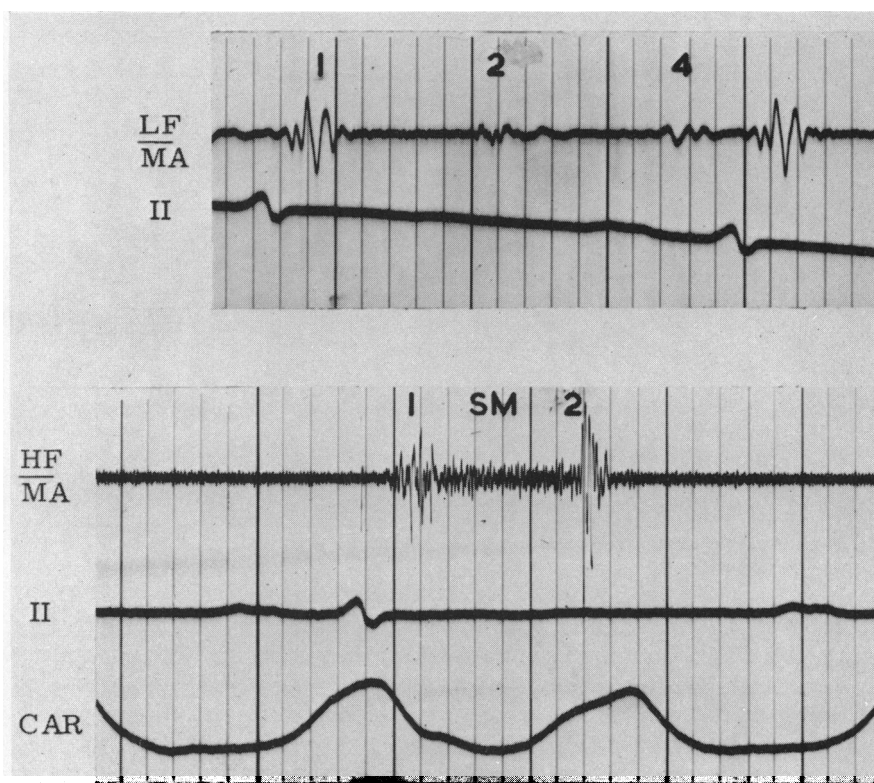


FIG. 1.—Mitral regurgitation in endomyocardial fibrosis. Low (LF) and high (HF) frequency phonocardiograms recorded from the apex (M.A.). The pansystolic murmur continues up to the second sound. A fourth sound is shown in the low-frequency recording. Note P mitrale patterns in the reference electrocardiogram.

In the four cases with tricuspid regurgitation the murmur increased in intensity in inspiration (Fig. 3). In one patient with gross tricuspid regurgitation, a short diastolic murmur immediately following the third sound was recorded in inspiration (Fig. 4). This murmur was considered to be a ventricular filling murmur, probably associated with the rapid inflow of blood from the right atrium to the ventricle during diastole (McMichael and Shillingford, 1957). The jugular venous tracings showed a high positive systolic wave assuming the aspect of a "systolic plateau" in one case (Fig. 3).

The Heart Sounds. The vibrations of the first sound were usually normal, with the exception of one patient, a child of 11 years, in whom they appeared increased.

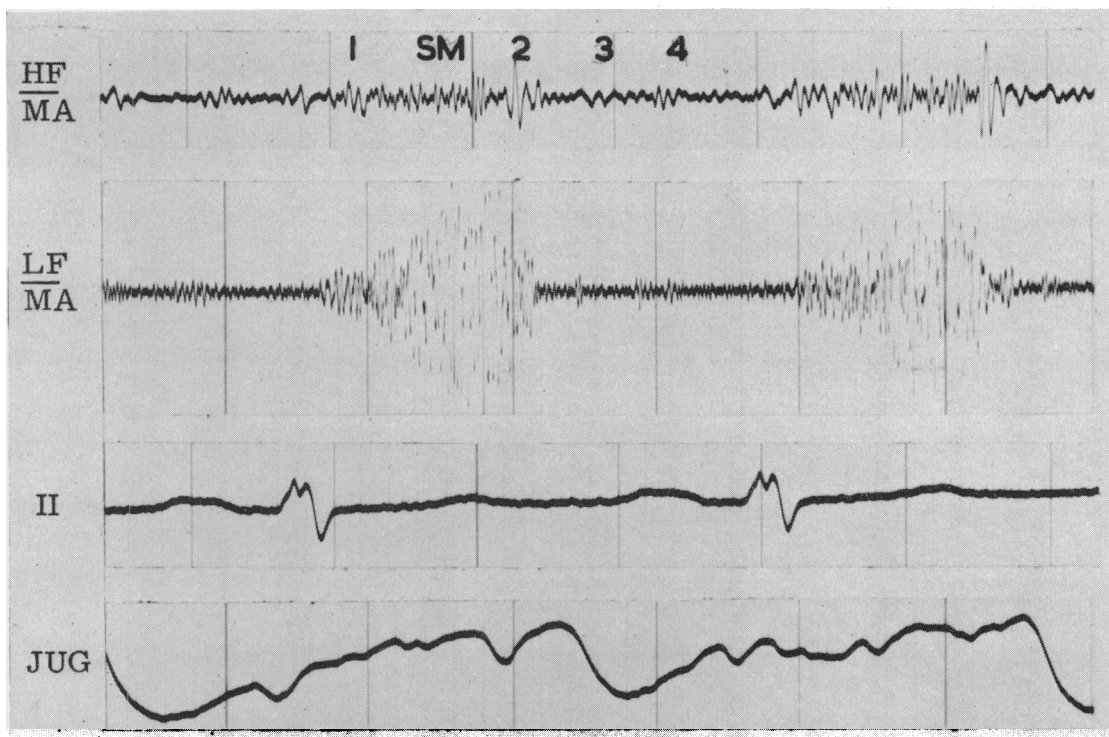


FIG. 2.—Mitral regurgitation in endomyocardial fibrosis. The systolic murmur is long, maximal in late systole, and extends up to and obscures the second sound at the apex. A quadruple rhythm is shown in the low-frequency (LF) recording. Note also P mitrale patterns in the reference electrocardiogram. The jugular pulse tracing (JUG) shows a positive systolic wave indicating tricuspid regurgitation.

The presence of a pansystolic murmur often made it difficult to distinguish the second sound. In two patients with a crescendo murmur in late systole, the second sound was completely obscured. In no case was an opening snap recorded.

The third sound was present in all records except in one patient with mitral regurgitation. In four patients with mitral regurgitation the third sound was much accentuated. Its presence might have been normal in two patients who were aged less than 30 years, but was probably due to increased filling of the ventricle in all cases.

It is remarkable that an atrial (fourth) sound was recorded in all but two patients with mitral regurgitation. The exceptions were one who had atrial fibrillation and one who had a normal P wave. All 12 patients with an atrial sound had a conspicuous bifid P mitrale with the exception of one in whom the P wave was normal. Three of the four patients with tricuspid regurgitation also had atrial sounds.

DISCUSSION AND CONCLUSION

The pansystolic murmur of atrioventricular regurgitation due to endomyocardial fibrosis has been found to be no different from the pansystolic regurgitant murmurs described in rheumatic heart disease (Leatham, 1951; Brigden and Leatham, 1953; Besterman, 1955; Leatham, 1958). In this respect atrioventricular regurgitation in endomyocardial fibrosis is indistinguishable from pure atrioventricular regurgitation due to rheumatic heart disease.

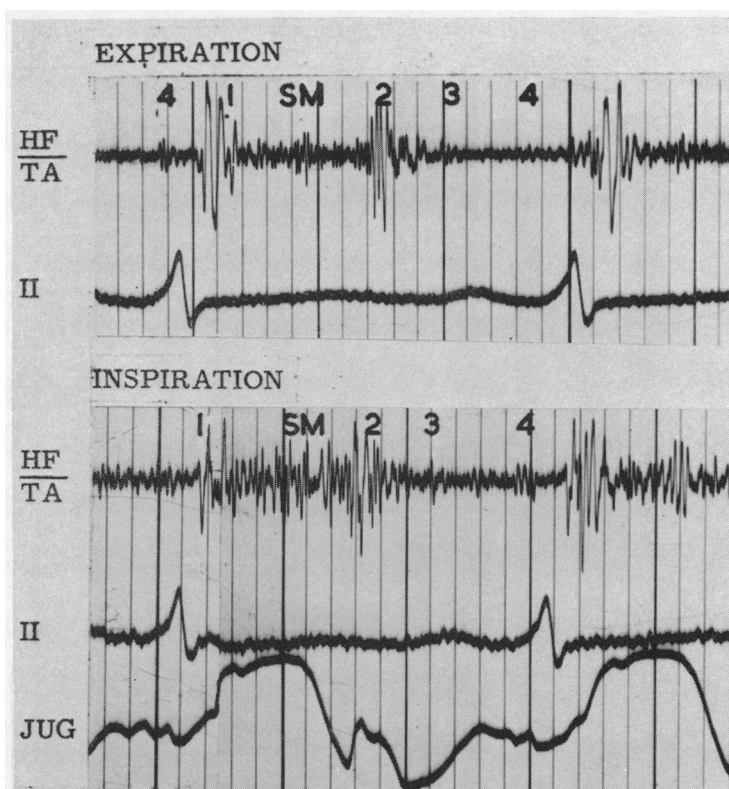


FIG. 3.—Tricuspid regurgitation in endomyocardial fibrosis. High-frequency (HF) phonocardiogram recorded from the base of the xiphoid process (T.A.), showing increase in intensity of the murmur in inspiration. There is a quadruple rhythm. The jugular venous pulse tracing (JUG) shows a high positive systolic wave with a "systolic plateau".

The difference arises with the ventricular filling sounds, both atrial and third sounds, which were present in nearly all the cases examined, producing quadruple rhythm. It may therefore be concluded that with the severe degrees of pansystolic regurgitant murmurs in endomyocardial fibrosis, quadruple rhythm is a common finding.

Both these diastolic sounds are generally attributed to filling of the ventricles and are probably caused by the sudden distension of the ventricular walls. The atrial sound is said to indicate an increased resistance to ventricular filling (Leatham, 1958), and this may be the result produced by the endocardial lesion. The close association with a P mitrale suggests that the abnormal fourth sound is in some way related to the considerable atrial hypertrophy, especially left atrial hypertrophy so frequently found in endomyocardial fibrosis.

SUMMARY

Fourteen clinically diagnosed cases of endomyocardial fibrosis and mitral regurgitation, of whom four also had organic tricuspid regurgitation, were studied by phonocardiography. The murmur was invariably pansystolic and was frequently accompanied by accentuated third and atrial sounds. The association of an atrial sound and the presence of P mitrale is discussed.

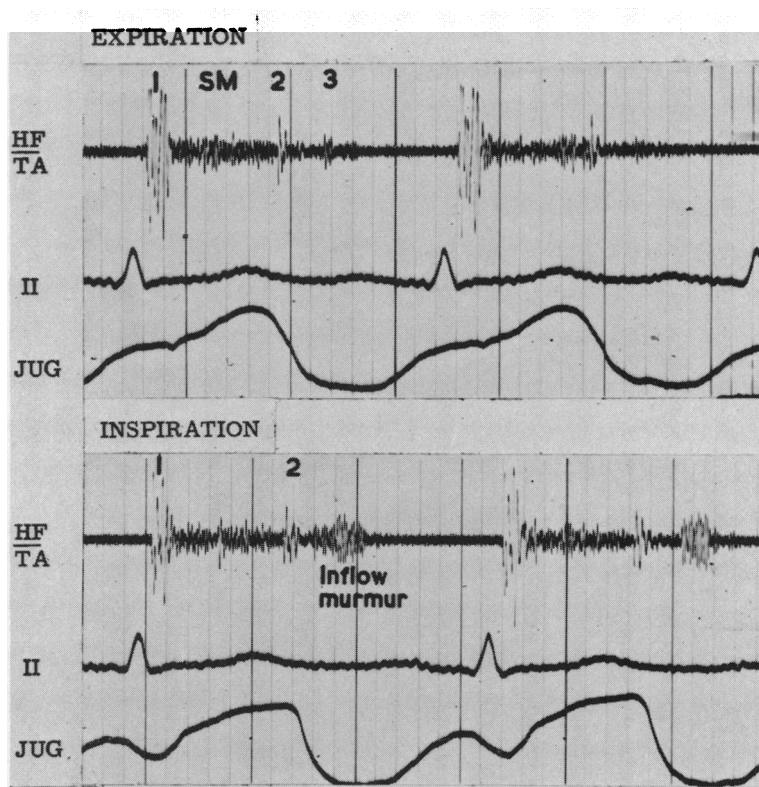


FIG. 4.—Tricuspid regurgitation in endomyocardial fibrosis. High-frequency (HF) phonocardiograms, showing short early diastolic “inflow murmur” immediately following the third heart sound in inspiration. The jugular venous pulse tracing (JUG) shows a “systolic plateau”.

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